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Studies on the Permo-Trias of Madagascar. 8. *Ankitokazoa bezanozanoi* n. gen. n. sp. (Annelida, Amphinomidae): a new fossil polychaete from the Olenekian (Lower Triassic) of the Ankitokazo Basin

Abstract - *Ankitokazoa bezanozanoi* n. gen. n. sp. from the Olenekian (Lower Triassic) of Betsiaka (Ankitokazo Basin, Ambilobé district, northern Madagascar) is described as an annelid polychaete of the family Amphinomidae Savigny in Lamarck, 1818 on the basis of a single specimen. A taxonomic indentification of the material examined is proposed thanks to the preservation of some soft parts: the eversible proboscis, the parapodia and, especially, the structure here interpreted as the caruncle, a nuchal sensory organ typical of the amphinomid polychaetes. The new *taxon* is compared with the other fossil polychaetes ud to date described as representatives of the order Amphinomida Lamarck, 1818.

Key words: Amphinomida, nuchal organs.

Riassunto - Studi sul Permo-Trias del Madgascar. 8. *Ankitokazoa bezanozanoi* n. gen. n. sp. (Annelida, Amphinomidae): un nuovo polichete fossile dell'Olenekiano (Triassico Inferiore) del Bacino di Ankitokazo.

Viene descritto un nuovo polichete fossile conservato in un nodulo proveniente dai livelli olenekiani (Triassico inferiore) di Betsiaka, località del Madagascar settentrionale (regione di Ambilobé) sita nel Bacino di Ankitokazo. Grazie alla conservazione di alcune parti molli, quali i parapodi, la proboscide evertibile e, in particolare, la caruncola, organo nucale a funzione sensoriale, questo nuovo *taxon*, *Ankitokazoa bezanozanoi* n. gen n. sp., vienc attribuito alla famiglia Amphinomidae Savigny in Lamarck, 1818. Sono state infine illustrate le principali differenze morfologiche tra la nuova specie descritta e gli altri policheti fossili che mostrano affinità con l'ordine Amphinomida Lamarck, 1818.

Parole chiave: Amphinomida, organi nucali.

Introduction

The modern annelids included in the order Amphinomida Lamarck, 1818 are usually bright coloured and shallow-water polychaetes, often indicated with the nickname 'fire-worms' or 'bristle-worms' because they are equipped with cutting and poisonous chaetae (spines) that easily break off and penetrate (Fauchald, 1977). They live in both shallow and deep-water, on various kinds of substrata, and

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they are mostly distributed in warm and tropical seas (George & Hartmann-Schröder, 1985; Rouse & Plejiel, 2001). The group includes both forms characterized by a typically elongate, worm-like body and forms with a short, ovate and more or less flattened body (Fauchald, 1977).

The most significant features useful to distinguish the amphinomids from the others free-living polychaetes are especially the caruncle and calcified chaetae (Fauchald & Rouse, 1997). The caruncle is a nuchal sensory organ sometimes provided with 4 or 8 ciliated ridges and attached or projecting to dorsum posterior to prostomium (Storch & Welsch, 1969). The caruncle is typical of two groups of free-living polychaetes (Fauchald & Rouse, 1997): the Amphinomidae Savigny in Lamarck, 1818 and the strictly related Euphrosinidae Williams, 1851. The Euphrosinidae share with the Amphinomidae also the calcification of the chaetae even if, differently from the latter, their notopodia are not truncated cylinders or cones but elongate transversal crests and their caruncle is usually three-lobed (Kudenov, 1987). In addition to the Euphrosinidae, within the Amphinomida some authors (Kudenov, 1991) recognize also the family Archinomidae Kudenov, 1991, including polychaetes with the caruncular structure of the euphrosinids and the parapodial orgnization of the amphinomids.

The fossil record of the Amphinomida is rather reduced since only 3 genera and species have been described to date (Bracchi & Alessandrello, 2005): *Meringosoma curtum* Ehlers, 1869 from the Kimmeridgian (Upper Jurassic) of Solnhofen (Germany) and *Paleocampa anthrax* Meek & Worthen, 1865 from the Pennsylvanian (Upper Carboniferous) of Mazon Creek (Illinois), the latter originally interpreted as a caterpillar (Meek & Worthen, 1865, 1868) and later also as a myriapod (Scudder, 1882, 1884). Moreover, Thompson (1979) described as belonging to the Amphinomidae about 30 specimens from the same site as *Paleocampa* and attributed them to *Raphidiophorus hystrix* Thompson, 1979, essentially because at that time *Paleocampa* was not considered a polychaete. In the following years, several authors (Pacaud *et al.*, 1982; Rolfe *et al.*, 1982; Heyler, 1986; Heyler & Poplin, 1988; Briggs & Kear, 1993) reported full-preserved polychaetes referable to *Paleocampa* from the Stephanian (Upper Carboniferous) of Montceau-les-Mines (France), suggesting that *Paleocampa* Meek & Worthen, 1865 and *Raphidiophorus* Thompson, 1979 are synonyms (Pacaud *et al.*, 1982). Recently, Pleijel *et al.* (2004) concluded that *Raphidiophorus* is a junior synonym of *Paleocampa*. However, the position of both *Paleocampa* and *Meringosoma* Ehlers, 1869 within the Amphinomida remains uncertain (Pleijel *et al.*, 2004; Bracchi & Alessandrello, 2005).

The aim of this study is the description of a specimen of annelid polychaete from the Lower Triassic of northern Madagascar (Betsiaka, Ambilobé district, Ankitokazo Basin) held in the collections of the Museo Civico di Storia Naturale di Milano (MSNM i25467). The research has been possible thanks to the cooperation between the Sezione di Paleontologia del Museo Civico di Storia Naturale di Milano and the Service de la Géologie du Madagascar.

The presence of polychaetes in the Lower Triassic of northern Madagascar has been already pointed out by Alessandrello (1990) who described the aphroditid *Paleoaphrodite anaboranoensis* Alessandrello, 1990 from the site of Anaborano,

few kilometres south-west of Betsiaka, the locality from which the studied specimen comes. Both Anaborano and Betsiaka are located in the Ambilobé district, where a marine sedimentary succession containing the fossiliferous levels outcrops for about 120 km, from south-west to north-east. This sedimentary succession has been traditionally considered Permo-Triassic in age (Besairie, 1952, 1972) and in the opinion of Beltan (1996) a Induan age (Early Triassic) seems likely. More recently, Yanbin *et al.* (2002) suggested an Olenekian age (Early Triassic) for the faunal assemblage of the Ambilobé district because of the presence, near the village of Ambilobé, of fossil conchostracans previously known in the Olenekian of the German basin.

The studies about the fossil invertebrates from the Ambilobé area do not deal only with polychaetes and conchostracans, but also with limulids, decapod, thylacocephalan and cycloid crustaceans, in addition to ammonoids, nautiloids, and bivalves (Arduini, 1990; Garassino & Teruzzi, 1995; Brambilla *et al.*, 2002; Garassino & Pasini, 2002; Pasini & Garassino, 2003; Hauschke *et al.*, 2004).

The polychaete taxonomy adopted in this work essentially follows Fauchald (1977).

Systematic Paleontology

Phylum Annelida Lamarck, 1809
Class Polychaeta Grube, 1850
Order Amphinomida Lamarck, 1818
Family Amphinomidae Savigny in Lamarck, 1818
Genus *Ankitokazoa* n. gen.

Diagnosis: same as the type species.

Derivatio nominis: the trivial name alludes to the Ankitokazo Basin where the type locality is placed.

Type species: *Ankitokazoa bezanozanoi* n. sp.

Ankitokazoa bezanozanoi n. sp.
Fig. 1, 2, 3, 4

Diagnosis: large-bodied amphinomid with a ovate/subrectangular body. Eversible proboscis present. Subtrapezoidal caruncle with thread-like (ciliated) ridges. Biramous parapodia consisting of two conical rami.

Derivatio nominis: referred to Bezanozano, one of the first tribes to become established in northern Madagascar.

Geological age: Olenekian (Lower Triassic).

Type locality: Betsiaka, Ankitokazo Basin, northern Madagascar.

Material: 1 specimen, MSNM i25467 (holotype).

Description: the specimen is dorso-ventrally preserved with both part and counterpart inside an ellipsoidal and slightly flattened nodule built of a strongly cemented, silico-argillaceous and red-brown rock, similar to that described by Besairie (1972) from the Ankitokazo Basin. The nodule is 154 mm long, 119 mm wide and 56 mm thick.

Excluding the parapodia and related structures, the imprint of the body appears oval/subrectangular, elongate and flattened, measuring 140 mm in its maximum length and 40 mm in maximum width. Considering also the parapodial structures, the body appears altogether ovate and reaches 63 mm in width. Except for the eversible proboscis and parapodia, the body is preserved as a dark-brown-red staining, shiny and black coloured in places. The metamerical organization of the body is not apparent in the fossil but can be inferred from the distribution of the structures interpreted as parapodia (see below).

The proposed everted proboscis is preserved as a subrectangular and reddish trace clearly visible at the cephalic extremity. The trace measures 21 mm in its maximum length and 12 mm in maximum width. Two subcircular imprints (diameter about 6 mm) at the anterior extremity of this structure, along its sides, may represent the imprints of the eyes.

Immediately behind the everted proboscis the imprint of a subrectangular structure is preserved both in the part and counterpart: the total length reaches 19 mm, the maximum width measures 13 mm at the posterior extremity, 5 mm at the anterior one. Thus, the shape of this structure appears altogether subtrapezoidal. Its surface is crossed by some thread-like ridges, particularly well visible in the counterpart. One ridge runs along the median line of the structure, the other ridges are transverse, perpendicular to it and reach the lateral margins. Five transversal ridges can be counted in the posterior portion but they are not preserved in the anterior portion. The features and the location of the structure suggest that this may be the caruncle, the nuchal sensory organ typical of the amphinomid polychaetes. The ridges observed on the surface of the structure may then represent the ciliated ridges that usually characterize the caruncular organs of the Amphinomida (Storch & Welsh, 1969). The preservation of the caruncle allows to recognize which surface of the fossil is dorsal.

Both in part and counterpart, the examined specimen preserves the imprint of the first three left parapodia. These parapodia clearly consist of two asymmetrical and subtriangular (in life probably conical) rami but the mediocre preservation of the fossil makes difficult to distinguish between notopodium and neuropodium. Probably the anterior rami represent the notopodia being preserved on the dorsal surface of the specimen. Unlike the body, the parapodia appear to be mineralized with a black, shiny and smooth material, probably with a high concentration of iron oxides (Besairie, 1972): the rami of each parapodium and the parapodia are separated by thin stripes of a lighter coloured matrix. The shiny and black material forms a continous 'coat' around the entire body of the animal. Both in part and counterpart, this 'coat' is crossed by thread-like stripes of matrix along the entire sides of the body: at least 27 can be counted along the right side, at least 25 along the left one. The stripes separate black, shiny and smooth areas of various sizes that, as above explained, represent the parapodia. The original form and boundaries of the parapodia included in this 'coat' are in most cases hardly recognizable. They probably were flattened and partially damaged before fossilization: it is impossible to establish when the stripes separate the rami of the same parapodium and when they separate adjacent parapodia.

No chaetae are preserved.

Fig. 1 - *Ankitokazoa bezanozanoi* n. gen. n. sp., MSNM i 25467a, part (impronta), (x 1.3).

Fig. 2 - *Ankitokazoa bezanozanoi* n. gen. n. sp., MSNM i 25467b, counterpart (controimpronta), (x 1.3).

Fig. 3 - *Ankitokazoa bezanozanoi* n. gen. n. sp., MSNM i 25467a, part (impronta): particular of a parapodium (particolare di un parapodio), (x 0.04).

Fig. 4 - *Ankitokazoa bezanozanoi* n. gen. n. sp., MSNM i 25467a, part (impronta): particular of caruncle and eversible proboscis (particolare di caruncola e proboscide evertibile), (x 0.4).

Discussion and conclusions

The polychaete affinities of *Ankitokazoa* n. gen. are essentially suggested by the presence of parapodia that offer an indirect evidence of a segmented body. Moreover, the presence of caruncle and eversible proboscis together with the general morphology of the body allow to relate this Triassic polychaete to the order Amphinomida. Finally, the conical shape of the parapodial rami and the presence of a structure here interpreted as a caruncle suggest location of *Ankitokazoa* n. gen. in the family Amphinomidae. Although it is rather common that the related Euphrosinidae show a general body shape very similar to that of *Ankitokazoa* n. gen., their notopodia are developed as elongate crests and, as is also the case of the Archinomidae, they usually possess a three-lobed caruncle (Kudenov, 1987, 1991, 1994; Fauchald & Rouse, 1997).

The most significant features useful for a systematic definition of *Ankitokazoa* n. gen. within the fossil Amphinomida deal with the caruncle. In *Ankitokazoa* n. gen. the former is not lobate but subtrapezoidal in shape and shows some thread-like ridges interpreted here as ciliated ridges.

In the Carboniferous *P. hystrix* the caruncle is heart-shaped but it does not show ciliated ridges (Thompson, 1979). Moreover, in *P. hystrix* all the chaetae are of uniform morphology, have a striated surface and increase their length from prostomium to pygidium, reaching the length of the body (Thompson, 1979).

Uniform chaetae with a striated surface are also present in the Carboniferous *P. anthrax*, in which the caruncle is not preserved (Plejiel *et al.*, 2004). Plejiel *et al.* (2004) illustrated the eversible proboscis of *P. anthrax* with concentric ridges interpreted by the authors as circular lamellae with thickened cuticle, apomorphy characterizing the Amphinomida. However, such structures are not evident in *Ankitokazoa* n. gen. as well as the chaetae.

Moreover *Paleocampa* differs from *Ankitokazoa* n. gen. in the general morphology of the body. The body of *Ankitokazoa* n. gen. is ovate/subrectangular and stubby, closely resembling that of the polychaetes known as sea-mices (Aphroditacea Fauchald, 1977), while the *Paleocampa* body is more elongate and narrower, more similar to that of a typical worm-like organism. Among the modern amphinomids both morphologies are known (Fauchald, 1977). An ovate/subrectangular body and a caruncle characterize genera such as *Chloeia* Savigny, 1818, *Notopygos* Grube, 1855 and *Sangiria* Horst, 1911. On the other hand the living *Amphinome* Bruguière, 1789, *Eurythoe* Kingberg, 1857, *Hermodice* Kingberg, 1857, *Linopherus* Quatrefages, 1865 and *Pherecardia* Horst 1886 are typical long-bodied polychaetes.

The general body morphology of *A. bezanozanoi* n. gen. n. sp. is more similar to that of the Jurassic *M. curtum*, described and figured by Ehlers (1869) with an ovate/subrectangular body. However, the specimen reported by Ehlers (1869) preserved chaetae and, as it seems, also the gills but lacks any remains of caruncle or parapodia. The structure of chaetae and gills together with the general morphology of the body induced Ehlers (1869) to suspect euphrosinid affinities for *M. curtum* despite the lack of any evidence both for notopodia developed as elongate crests and a three-lobed caruncle.

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